KODIAK MANAGEMENT AREA
HERRING REPORT
TO THE
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By

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SAC ROE HERRING FISHERY

Area Description

The Kodiak Management Area (KMA) comprises the entire Kodiak archipelago and that portion of the Alaska Peninsula which drains into Shelikof Strait between Cape Douglas and Kilokak Rocks at Imuya Bay. The archipelago is approximately 150 miles long, extending from Shuyak Island south to the Trinity Islands. The Alaska Peninsula portion is about 160 miles long and is separated from the archipelago by the Shelikof Strait that averages 30 miles in width (Figure 1).

Historical Perspective

The Pacific herring (*Clupea pallasi)* commercial sac roe herring fishery began in Kodiak in 1964. From 1964-1998 sac roe herring harvests averaged 1,951 short tons (tons) (Table 1; Figure 2). From 1964-1977 purse seine gear was used exclusively, with an average annual harvest of 898 tons. Prior to 1974, the fishery was unregulated with regard to harvest quotas, gear types, seasons, and fishing periods. Annual harvests, along with effort levels, fish abundance, prices and processor interest fluctuated greatly from 1964 through 1977. Improved market conditions in 1978 prompted increased effort in this fishery with 28 purse seiners and 7 gillnetters participating. Between 1977 and 1982 the regulatory and management strategy went through a rapid developmental phase. It was during this time period that spotter aircraft and tenders became involved in the fishery. Regulatory changes focused on gear efficiency, gear conflicts between seiners and gillnetters, gear level restrictions (exclusive registration and limited entry) and closed waters.
Season Dates:

From 1974-1978 the season ran from March 1 through June 30 and from 1979-1981 it was reduced to May 1 through June 30. In 1982 the season opening date changed to April 15 and the April 15 to June 30 season dates remain in effect.

Fishing Periods

Fishing periods from 1974-78 were 24 hours per day and seven days per week. In 1979 and 1980 the fishing period were scheduled with 48 hour openings followed by 24 hour closures. In 1981 the fishing periods were further reduced to 24 hour openings followed by 24 hour closures which remained in effect through 1995.

Guideline Harvest Levels

From 1974-1978 there was an area wide harvest quota of 3,400 tons. From 1979-1984 the area wide harvest quota was reduced to 2,400 tons and guideline harvest levels (GHLs) were established for four large geographical areas. Descriptions of districts and sections were established in regulation in 1981, with seven districts and 46 sections listed. Starting in 1985 GHLs were established on an

annual basis by section and were based on stock status trends. From 1985-1998 the combined annual GHLs of all sections has ranged from 1,640 tons in 1987 to 4,550 tons in 1994.

Gear

Purse seine gear was unrestricted in this fishery through 1973, but was limited in 1974 to 150 fathoms in length and 1,000 meshes in depth. Gillnet lengths were first restricted to a maximum length of 300 fathoms in 1979 and there was no depth restriction. The maximum lengths for gillnet and purse seines were reduced again in 1981 to 150 fathoms and 100 fathoms, respectively and these regulations remained in effect through 1995. Also in 1981, trawl and beach seine gear was eliminated as legal gear during the sac roe season.

The overall regulatory effect during the developmental phase (1977-1982) was the emergence of a relatively stable sac roe herring fishery through 1991. Two strong year classes from the 1987 and 1988 brood years resulted in dramatically increased stocks and record to near record harvests occurring in 1992 through 1995 seasons, averaging 4,927 tons (Table 2). The contribution of these older age classes to the fishery was significantly reduced in 1998 and the harvest was 2,057 tons.

Beginning in 1979, combined gear levels increased substantially, reaching a high of 201 units (92 seiner and 109 gillnet) and 193 units (79 seiner and 114 gillnet) in 1980 and 1981 respectively (Table 2 and Figure 3). With the implementation of limited entry following the 1981 sac roe season, new entry into the fishery was restricted to past participants until permanent transferable permits could be awarded. From 1982-1993, gear levels were relatively constant with 29-41 seiners and 62-86 gillnetters participating. With an increase in KMA herring stocks, an increase in herring prices, and closure of the Prince William Sound herring fishery, seine gear levels increased abruptly for the 1994-1997 seasons. The escalation in seine gear resulted in increased competition amongst seiners and between seiners and gillnetters.

Regulation Changes from the 1995 Board of Fisheries Meeting

With the increase in the herring stocks and effort levels, competition in this fishery dramatically increased and changes in the fishing schedule were made inseason in 1995. This change in the fishing schedule was prompted by: 1) ADF&G's inability to monitor the purse seine fleet during the night, 2) near record numbers of purse seine gear participating in the fishery, and 3) low roe recovery standards which were set by some processors (Gretsch 1995). These factors prompted ADF&G to shorten the duration of fishing periods to slow the harvest rates of purse seiners. Due to regulatory constraints, the shorter periods applied to both purse seine and gillnet fishers. With the changes in the fishing schedule, along with a diminishing percentage of catch going to the gillnet fleet, tension between the two gears types escalated. A work group was established by the Kodiak Fish and Game Advisory Committee comprised of seine and gillnet fishers along with ADF&G staff to develop a solution to these issues to be presented to the Alaska Board of Fisheries (BOF).

The BOF met in Kodiak in December 1995 and adopted new regulations concerning gear specifications for seine and gillnets, fishing periods and a harvest strategy which guide's

management of the sac roe herring fishery. The major change addressed by the BOF in 1995 was the shortening of fishing periods for purse seiners. The BOF regulatory harvest strategy reduced fishing time for purse seine gear from 24 hour to 13 hour fishing periods, (12:00 noon to 10:00 p.m. on odd-numbered days and 9:00 a.m. to 12:00 noon on even numbered days of the month), from April 15 through May 4 (ADF&G 1998). From May 5 through June 30 the fishing periods for purse seiners are 12:00 noon on odd-numbered days to 12:00 noon on even-numbered days of the month, (24-hour periods). The ADF&G may adjust the May 5 date earlier or later depending on the assessment of effort levels, harvest rates, and ADF&G's ability to monitor the fishery. Gillnet fishing periods remain unchanged, with 24 hour fishing periods from 12:00 noon on odd-numbered days until 12:00 noon on even-numbered days of the week for the duration of the season.

In 1995 the purse seine gear specifications were changed to allow for a maximum of 20 fathoms stretch measure in depth from the corkline to the bottom of the net including any lines which hang below the lead line. In addition, the gillnet gear specifications were changed to restrict nets to a maximum depth of 230 meshes and allows a total of four hours for fishers to pull their gear after an emergency closure, an increase of two hours from the previous regulation.

Harvest Strategy Evaluation

The BOF had two intentions when the harvest strategy was adopted, 1) conservation issues; primarily the frequent and greatly exceeding of GHLs and 2) preserving the historic harvest balance between seine and gillnet gear, with gillnet gear harvesting 20-30 percent of the total harvest.

There are many factors that contribute to harvest rates within the KMA fishery. These factors include effort levels, the availability of the biomass, and weather conditions. The current seine specifications are known to be capable of harvesting 100 tons in a single set. The harvest potential from a single vessel can easily exceed the majority of the smaller sections GHLs that range from 10-50 tons.

In comparing the harvest to the GHL for the three seasons prior (1993-95) to the 1995 BOF harvest strategy, to the three seasons after (1996-98) the harvest strategy, the department has been more successful in managing this fishery. There are four districts that have produced the bulk of the harvest (92-100%) in recent years (1993-1998) which include the West Afognak, Uganik, Eastside, and Alitak Districts. The West Afognak and Uganik Districts have received the highest gear levels and these fisheries generally occur during the first two weeks of the season. The West Afognak District harvest has ranged from 23-241% greater than the GHL and averaged 71% above the GHL for the 1993-95 seasons (Table 3). For the 1996-98 seasons the harvest ranged from 20% below to 8% above the district GHL and the harvest averaged 6% below the GHL. In the Uganik District the 1993-95 harvest ranged from 46-184% above the GHL, and averaged 101% above the GHL, while during the 1996-98 seasons the harvest ranged from 3-35% above the GHL and averaged 19% above the district GHL.

For the Eastside and Alitak Districts several sections within these districts have experienced declines in stock abundance starting in 1995. In several of these sections the GHLs may have been set too

high and the less than anticipated fishery performance resulted in GHLs not being met. For the Eastside District in the 1993-95 seasons there were harvests that ranged from 9% below to 42% above the GHL and averaged 10% above. For the years 1996-98 the harvest ranged from 31% below to 2% above the GHL and averaged 20% below the GHL. Similarly, the Alitak District had harvests that ranged from 36% below to 31% above the GHL and averaged 2% above the GHL for the 1993-95 seasons and harvests ranged from 34% below to 1% below the GHLs for the 1996-98 seasons and averaged 23% below.

The reduction in purse seine fishing periods for the 1996 through 1998 seasons has aided the management of this fishery. During the first two weeks of the season when effort levels are the highest, the 13 hour fishing periods were crucial in controlling the harvest in this fishery and preventing overexploitation of KMA herring stocks. Prior to the 1996 season, it was very difficult and dangerous for ADF&G's field crews to monitor the seine fleet in darkness (10:00 p.m. to 6:00 a.m.) from small rafts and skiffs. The 10:00 p.m. closure time has elminated the unrestricted seine fishery during the night and has reduced the time field crews must work in potentially dangerous situations.

The second intent of the BOF harvest strategy was to preserve the historic harvest balance between seine and gillnet fishers, with 20-30% of the harvest going to gillnet gear. From 1979-1998, the percentage of harvest for purse seine gear has ranged from 60% to 85% and gillnet gear 15% to 40% (Table 2). For the 1993-1995 seasons gillnetters averaged 16% of the total harvest and from 1996-98 the gillnet harvest was 31%, 19%, and 5% respectively, with an average of 18%. The sharp decline in the harvest percentage in 1998 is a result of record low participation in the fishery with only seven gillnetters making a delivery, however the average catch for gillnetters was the second highest in the history of the fishery and averaged 15 tons. In 1998 both gear types experienced sharp declines in effort levels that can be attributed to the low herring prices paid in 1997 and a low price outlook for the 1998 season. Fishers also had the option to participate in the state waters cod jig fishery, which provided a more lucrative option for gillnetters. The intent of the BOF to preserve the historic balance of harvest was achieved for the 1996 and 1997 seasons, however this balance was not achieved in 1998 because of record low participation by the gillnet fleet.

Districts and Management Sections

The KMA is divided into 13 districts, which define geographical areas used in managing the sac roe and food and bait herring fisheries (Figure 4). For the sac roe fishery, each district is divided into management sections that are intended to define the spawning area used by a stock of herring or may be used to define a geographical area. There are a total of 82 management sections.

Guideline Harvest Levels

Preseason GHLs are established for all management sections, which have produced consistent herring harvests in previous seasons. These GHLs reflect the status of a particular stock of herring by management section and range from 10 tons for the smaller stocks to 400 tons for the larger

stocks in 1998 (Table 4). Criteria for establishing the 1998 GHLs involved evaluation of a variety of information to determine stock status trends and conservative adjustment of GHLs to reflect the following trends: 1) fishery performance during preceding season or seasons, (i.e., harvest timing, harvest duration, average school size, roe recovery percentage), 2) trends in age composition (i.e. level of recruitment (age-3) in catch samples, proportion of the spawning population age-5 and younger, proportion of age-2 fish in the spawning biomass (indicator of future recruit strength)), 3) spawn and juvenile herring observations, 4) industry and department aerial surveys, 5) hydroacoustic surveys, 6) test fishery to obtain additional age composition and biomass estimates, and 7) aged-structured analysis (ASA) modeling. The department can adjust the GHLs during the season if it appears that preseason expectations are incorrect.

From 1979-1984 the KMA GHL was fixed at 2,400 tons. From 1985-1998 the GHL has varied each year (based on the criteria listed above) from a low of 1,640 in 1987 to a high of 4,550 in 1994. The preseason GHL has accurately reflected the actual harvests (Figure 5). These preseason harvest projections aid fishermen and processors in planning prior to the start of each season.

Fishery Characteristics

The current KMA sac roe herring fishery occurs from April 15 through June 30 in 30-40 bays and coastal locations. The fishery opens at 12:00 noon on April 15, with the entire management area opening at one time, excluding those areas where local stocks require protection. A unique characteristic of this fishery is that it typically commences prior to any major build-up of herring. This allows for a greater distribution of effort, which should reduce harvest rates within individual bays. Both gear types fish the same areas during the same time periods, except for the April 15 to May 4 time period, (unless modified by emergency order) when purse seine fishing is closed from 10:00 P.M. to 9:00 A.M..

To reduce operational costs and to cover more areas, most purse seiners form combines of two to ten vessels. These combines include one or several tenders and spotter aircraft. Airplanes are the most productive way to find and direct seiners to harvestable herring.

Gillnet vessels generally work independently and usually rely on processors to provide tenders to deliver their fish to the processing location. A few gillnetters are equipped with scanning sonar but the majority of these fishermen rely on color down-sounding sonar to locate herring schools, or fish areas where seiners are making sets. In recent years the use of mechanical shakers has increased. The herring shaker greatly reduces the time and effort needed to remove herring from the net and greatly increases gear efficiency.

The ADF&G relies on the fishing industry to establish roe recovery standards. Generally, tenders will have a processor representative onboard to ensure that marketable sac roe quality herring are harvested. Competition among shore-based and floating processors results in this fishery having one of the highest exvessel values per ton in the state. The quality of Kodiak sac roe herring is generally high, due to inseason handling of a relatively small amount of herring over a long time period.

Fishery Monitoring

This fishery is primarily managed on the fishing grounds by the stationing of department management personnel aboard state vessels or at shorebased tent/cabin field camps. Field and vessel crews are stationed in management sections that have historically produced the major harvests for a district. These crews are positioned in remote bays by chartered floatplanes or vessel and are equipped with an inflatable raft or skiff. Daily contact with fishermen, spotters and tender operators is maintained to acquire fishery data. Office management staff receive field crew fishery reports several times daily that include current harvest, effort levels, and fleet movement information that is reported by single side band (SSB) radio or satellite phone systems. The use of field crews has been a key element in supporting this fisheries harvest strategy in addition to preventing an excessive harvest from occurring. Field crews also identify herring spawning areas and collect age-weight-length (AWL) samples from the commercial harvest. ADF&G aerial surveillance of the entire area supplements and often directs the placement of fishery monitoring field crews.

Inseason Fishery Management

Processors and independent tender operators are required to provide daily tallies of herring deliveries by management section and accurate estimates of herring onboard tenders that have not yet delivered to the cannery. The Department tallies field crew, processor, and tender reports to assess herring harvests. Generally, once the harvest estimates meets or approaches the GHL a management section is closed by emergency order for the season. Due to the rapid pace at which some fisheries occur, inperiod closures are frequent. In management sections which have an ADF&G field crew present, inperiod closures may occur with as little as five minutes advance notice on the grounds. In management sections which do not have field crews present inperiod closures may occur by: 1) announcement on single side band frequency 4.125 MHz following the marine weather forecast at 8:00 A.M. or 6:00 P.M. daily and at 10:30 P.M. by ADF&G announcement, or 2) field announcement with the arrival of an ADF&G representative.

Timely and accurate harvest reports from ADF&G field crews, fishermen, spotters, and processors are critical for assessing herring harvests and guide the management of the fishery. To date, industry cooperation has been excellent in support of this fishery. A "Kodiak Sac Roe Herring Harvest Strategy" is distributed annually, which describes in detail the GHLs, regulatory changes, and expected fishing periods (Gretsch 1998a).

1998 Season Summary

The majority of the 1998 harvest occurred during the first two weeks of the season with the last harvest occurring on June 3 (Figure 6). A total of 42 permit holders made 136 deliveries during the 1998 season, with 35 purse seiners and 7 gillnetters harvesting 2,057 tons (Table 2). Approximately 47 purse seiners actually participated in this year's fishery with 12 vessels not make any landings for the season. Eight gillnetters participated in the fishery with seven making at least one landing during the season. Effort levels were sharply down for both gear types this season due primarily to

uncertainties concerning the 1998 herring price. The total 1998 guideline harvest level (GHL) was 2,030 tons which was distributed among 32 sections, with harvests occurring within 21 sections (Table 4 and Figure 4). The 1998 harvest of 2,057 tons was the smallest harvest since 1986 and was 27 tons greater than the total KMA GHL of 2,030 tons (Figure 5). Purse seine gear accounted for 95% (1,954 tons) of the harvest with gillnet gear accounting for 5% (103 tons) (Figure 7). A total of 47 tenders were registered to transport herring to processors. There were three floating processors and seven shore based plants registered to process herring. Roe recovery percentages averaged 10.6% for seine gear and 10.5% for gillnet gear.

From April 15 through May 4 purse seine fishing periods were restricted to 13-hour periods. In late April the purse seine, tender, and floating processor fleet participating in the KMA fishery diminished and most vessels moved to the Bristol Bay herring fishery. Harvest rates had also diminished in late April (Figure 6) and all of the ADF&G field crews were actively monitoring the primary sections where harvests were anticipated to occur. With this reduction in effort, reduced harvest rates, and good coverage of the fishery by ADF&G field crews purse seine fishing periods were increased to 24-hour openings followed by 24-hour closures beginning May 5, for all sections not previously closed to fishing. Gillnet fishing periods were 24 hours in duration, from 12:00 noon on odd-numbered days of the month to 12:00 noon on even -numbered days of the month for the duration of the season.

The 1998 fishery was monitored by four ADF&G shorebased field crews and two ADF&G vessels. These crews monitored the fishery to gather harvest data and collect commercial catch samples to obtain age, weight, and length (AWL) data. A total of 20 emergency orders were issued during the season which established or adjusted fishing periods and closed sections when GHLs had been reached.

Exvessel Value of the Fishery

Herring prices peaked in 1996 at approximately $2,000 per ton for 10% roe recovery and dropped to $300 per ton for the 1997 and 1998 seasons. The average 1998 exvessel earnings for purse seine fishers was $16,700 and $4,400 for gillnetters (Figure 8). The total exvessel value of the 1998 fishery was $617,100, which is the lowest total value in the history of the fishery (Figure 9). The previous record low value of the fishery occurred in 1997 when 3,235 tons were harvested and was worth $970,500.

Biomass Estimates

The ADF&G has attempted in previous years to conduct aerial surveys to assess the total KMA herring biomass. The results of aerial assessments provided only a limited evaluation of the biomass and did not give a true representation of the total biomass. Problems associated with aerial surveys in the KMA include: 1) herring tend to spawn in the evening, night, and early morning hours, limiting the time fish are visible in shallow water, 2) most management sections have many distinct schools of herring which will spawn from April through June, 3) large numbers of juvenile herring,

spawning herring, spawned out herring, and other fishes such as capelin can be found in sac roe herring fishery areas (fish may stay within an area for the duration of the sac roe season or may move, so that aerial biomass estimates may be duplicated or be incomplete), 4) the large geographical area of the KMA, and 5) adverse weather conditions. Industry spotters have helped greatly in past seasons by providing biomass estimates, spawn observations, fleet movements and harvest estimates. These spotters are very experienced; many having been involved for several seasons in the KMA and other statewide herring fisheries. There appears to be a significant amount of subtidal spawning occurring in waters 10-20 fathoms in depth. These fish and spawning activity may not be detected from aerial surveys. Previous attempts to assess this subtidal spawning with divers were not successful.

1999 Harvest Expectations and Stock Status

Herring harvests in the West Afognak and Uganik Districts have strongly relied on a dominant single age class of herring from the 1988 brood year to support these fisheries in the recent years of record harvest 1992-1997. The 1998 contribution to the fishery of these age-10 herring ranged from 6-25% by section (Table 5). Harvests from these districts accounted for 65% of the total 1998 KMA harvest. Several sections within these districts experienced fair to good recruitment of age-3 herring in 1998, however most of the 1999 harvest will be dependent on the abundance of age-5 and age-6 fish.

Similarly, the sections of the Eastside District have relied on a strong single age class (the 1987 brood years) to support these fisheries through 1997. In 1998 the age-11 fish contribution to the section harvests ranged from approximately 1-18% and will likely diminish further in 1999. Recruit herring (age-3) harvested in the 1998 fishery indicates poor recruitment for the Eastside District in 1998. Age-5 herring dominated the 1998 Eastside District harvest and contributed 66-94% of the section harvests. The 1999 Eastside District fishery will likely be dependent on the abundance of age-6 herring for the majority of the harvest.

The Alitak District has also experienced declines in herring abundance in recent years and during the 1998 season only three of the ten sections of the district were open to fishing. The Uyak District, South Afognak District, and most of the North Afognak District were closed for the 1995-1998 seasons due to a decline in herring abundance in 1991-1994. The Tonki Bay section was reopened for the 1998 season based on 1997 aerial survey data, however no harvest occurred. Several sections of the Inner Marmot District were also closed for the 1996 and 1997 seasons and in 1998 the entire district was closed. In addition, the Raspberry Strait and Malina Bay sections were closed to fishing in 1997 and 1998 as fishery performance was poor in 1995 and in 1996. The Northeast District was also closed for the 1998 season based on declining sac roe fishery performance and a harvest in the fall of 1997 of 120 tons during the food/bait fishery which was thought to have greatly impacted this stock.

For the 1998 season, ADF&G reevaluated the sections that have been designated exploratory or that had assigned GHLs but little history of sac roe herring harvest. Several of these exploratory sections were assigned a GHL while the remainder were closed to fishing. Fishery management options for

these closed sections will be discussed during the winter and these same areas will likely be closed to fishing again in 1999. The 32 sections that were open to fishing in 1998 will likely be open in 1999. Setting the 1999 GHLs for the KMA sac roe herring fishery will be under evaluation during the winter and will be published in the Kodiak Sac Roe Herring Harvest Strategy in mid-March, 1999. The contribution of the older age classes to the 1999 fishery is expected to drop sharply from the 1998 levels. The preliminary 1999 GHL is anticipated to be approximately 1,700 tons which is approximately a 15% reduction from the 1998 GHL.

Stock Assessment Programs

The ADF&G proposed to conduct a test fishery revenue-gathering program in 1997 and 1998 to harvest approximately 50 tons of herring. These funds were intended to be utilized to conduct additional aerial surveys of the closed sections, and to contract a seine vessel to make test sets on herring schools in the Uyak District. Due to the low herring price, the test fish program was halted as the necessary funds ($100,000) could not be raised in a reasonable manner. Several ADF&G aerial surveys along with aerial surveys from industry spotters continue to indicate that the Uyak stocks are still depressed and the ADF&G hopes to conduct a more intensive stock assessment program in 1999 as funding allows.

In recent years the ADF&G has also proposed doing hydroacoustic surveys of the East and West Sitkalidak Strait sections to assess the early spawning biomass within these areas if funding, personnel, and equipment were available. In late March and early April of 1989-1998, a herring biomass of unknown size has spawned in the East Sitkalidak Strait prior to the start of the fishery. This spawn activity indicates the total biomass within this section is larger than the actual fishery performance indicates, however the size of the biomass is unknown. A purse seiner was contracted in late March 1998 to make test sets on herring schools and conduct a hydroacoustic survey of the Sitkalidak Strait area. This limited survey did provide AWL data, which revealed the presence of older age class herring (age-7, -8, -10, and –11) that were not present in the commercial fishery harvest for this section. The hydroacoustic survey found multiple schools of spawning herring in several locations within the Sitkalidak Strait but overall school sizes and distribution did not indicate that a large biomass was present during the survey period.

The ADF&G headquarters and Kodiak Area research staff have conducted an age-structured analysis (ASA) on the West Afognak and Uganik Districts. This study method is dependent on an accurate biomass estimate, however this information is not available each year for these districts.

Enforcement Issues

The Alaska Department of Public Safety, Fish and Wildlife Protection (FWP) substantially increased their enforcement coverage of the KMA herring fishery during the last three seasons. The FWP vessel P/V Trooper has worked jointly with ADF&G in monitoring the fishery and conducting enforcement work, and has allowed a fishery monitoring technician to stay onboard. Additionally,

the FWP vessel P/V Spiridon, P/V Wolstad and a FWP float equipped Cessna 185 provided surveillance of the fishery.

The presence of FWP greatly reduced the burden on ADF&G field crews, especially during openings, closures, and inperiod emergency closures. During the fishery, the majority of the enforcement activity occurs on early (prior to the 12:00 noon or 9:00 am openings) or late (after the closure time) purse seine sets. For the last five years purse seine fishers have had problems determining section boundaries within the Uganik District, with the boundaries of the Village Islands Section being the most problematic. It is hoped that FWP will continue this level of enforcement activity, which ensures a more orderly fishery.

HERRING FOOD/BAIT FISHERY

Historical Perspective

The earliest recorded commercial food and bait herring harvest for the KMA occurred in 1912 (Table 6). In the early 1920's the fishery expanded and large herring were sought for food products, such as salted and pickled herring which were much in demand after World War I. By the late 1920's the demand for herring food products had declined and the fishery switched from a food product to reduction products, such as fishmeal and oil. During the peak years of the reduction fishery (1934-1950) the average harvest was 31,600 tons, which vastly surpasses the current food/bait herring harvests (Figure 10). During the reduction fishery the major harvest areas were located in eastern Shelikof Strait and adjacent bays and straits along the west side of Kodiak and Afognak Islands. Quotas and harvest weights were measured by barrels (where 250 lbs. of herring equals one barrel) until 1956 when the unit of measure was changed to short tons. Historically large, approximately 70 foot, "sardine seiner" type vessels were used in conjunction with holding pounds to supply herring to five major reduction plants. In addition, small seine and gillnet vessels participated in a portion of the food fishery and delivered to floating and shore based salting and pickling operations.

From the early 1960's to 1973, there were no harvest quotas or closed seasons. Beginning in 1974, an open fishing season was established between July 1 through February 28 that remained in effect through 1980. In 1979 and 1980, GHLs were established at 12,600 tons for the food and bait season. The season opening date for the fishery changed from July 1 to August 15 for the years 1981-1984. In 1985 the season dates were established to run from August 1 through February 28 and these dates have remained in effect through the 1998 season. As a result of the rapidly developing sac roe fishery, the GHL for the food/bait season was reduced to 1,000 tons in 1981 and remained at that level through 1987. Regulatory GHLs for the food/bait herring fishery were replaced with a regulatory harvest strategy in 1988.

Gear used in this fishery includes trawl, gillnet, and seine. Gear for this fishery was first regulated for the 1986/87 season when seine gear was restricted to 100 fathoms in length and 1,025 meshes in depth. Gillnet gear was also restricted to 150 fathoms in length with no depth requirements. For the

1993/94 season, purse seine specifications were increased to 150 fathoms in length and 1,625 meshes in depth. With these changes seine gear became more competitive with trawlers, with seiners harvesting an average of 54% of the total harvest for the years 1993-98 compared to only 2% from 1987-92 (Table 7; Figure 11). There are no trawl restrictions. All three gear types fish the same areas and have the same fishing periods.

Fishery Characteristics

The current food/bait herring fishery can be characterized as a secondary commercial fishery on herring concentrations located in KMA waters. It is primarily a bait fishery providing a frozen product for longline and crab/cod pot fishers. Effort and harvest levels are at historical lows for the food/bait fishery, while the sac roe fishery supports relatively high levels of effort and harvest. The food/bait fishery is an open-to-entry fishery, while the sac roe fishery has been limited-to-entry since 1981. Existing regulations designate priority status to the sac roe fishery.

Management Plan History

During the fall and winter months of the early 1980's, major concentrations of herring were observed in eastern Shelikof Strait and adjacent bays along the west side of Kodiak and Afognak Islands. The biomass exceeded that of known KMA spawning stocks. Food/bait fishers targeted these herring and questions arose concerning the stock of origin of these fish. In 1986, a stock identification study based on scale pattern analysis was performed on herring harvested from a large biomass located in the east part of the Shelikof Strait (Johnson et.al.1988). The study concluded that at least 80% of the East Shelikof herring sampled were of Kamishak Bay spawning stock origins, which is within the Lower Cook Inlet Management Area.

In 1988, the BOF allocated not more than two percent of the previous season's total available spawning biomass from Kamishak to be harvested during Kodiak's food/bait herring fishery. For local Kodiak spawning stocks, which are exploited during the sac roe fishery, the food/bait GHL on those same stocks is 10% of the previous season's sac roe herring harvest.

Problems arose from this management plan because it was difficult to assign harvest from the intermixed stocks to Kodiak or Kamishak when both areas had similar age compositions. This plan was in affect through the 1992/93 season.

In 1992, the BOF approved the Kamishak Bay District Herring Management Plan (5 AAC 27.465) which outlines criteria for the management of the Kamishak Bay sac roe herring and the Shelikof Strait food/bait fishery (ADF&G 1998). This plan defines allocations to these fisheries based on biomass estimates.

In 1993, the BOF placed into regulation a harvest strategy defining the criteria for managing the Kodiak food/bait herring fishery (5 AAC 27.535). This strategy combines the Kamishak stock GHL with the Kodiak stock GHL for food/bait management districts FB 1 (West Afognak District), FB 4

(Uganik District), and FB 5 (Uyak District) (Figure 4). This portion of the KMA bait fishery is referred to as the Shelikof Strait Food and Bait Herring Fishery. The Kamishak allocation generally ranges from 1-2% of the Kamishak spawning biomass. When this combined GHL is achieved, the Shelikof Strait food and bait management districts are closed collectively. This plan alleviates the problem of identifying the spawning stock of a harvest in areas where intermixing may occur. This plan also closes the Kamishak Bay sac roe fishery and the Shelikof Food and Bait Fishery north of the latitude of Miners Point (Figure 12) when the Kamishak spawning biomass falls below 8,000 tons.

1998-99 Season Summary

In August, 1998 the Kamishak spawning biomass was estimated to be below 8,000 tons and the 1999 Kamishak sac roe fishery was closed along with the 1998/99 Shelikof Strait Food and Bait Fishery north of the latitude of Miners Point. For the Kodiak stocks, only that portion of the Uganik District south of the latitude of Miners Point (Figure 12) and the Eastside District (Figure 4) were open to fishing with GHLs of 78 tons and 66 tons respectively. The KMA food/bait herring season runs from August 1 through February 28. Fishing periods were established by emergency order, limiting the fishing periods to 12 hours in duration (8:00 a.m. to 8:00 p.m.) seven days per week, beginning on August 17. Fishing periods were first restricted to 12 hours in duration midseason in 1997. Prior to 1997 fishing periods were unrestricted and were 24 hours per day, seven days per week. The reduction in fishing period length was intended to slow harvest rates to ensure that GHLs were not greatly exceeded. A harvest strategy, "KMA Commercial Food/Bait Herring Fishery Harvest Strategy" is distributed annually, which describes in detail the guideline harvest levels, regulatory changes, and registration requirements (Gretsch 1998b). All permit holders, tenders, and buyers are required to register at the Kodiak ADF&G office prior to fishing or purchasing herring. For the 1998/99 season the conditions of the registration permit were changed to improve the procedures permit holders must comply with concerning catch reporting to the department. During the registration permit process department staff issue harvest strategies, discuss current regulations and open areas, and review the catch reporting requirements. Fisher cooperation with reporting requirements greatly improved this season as a result of the stricter requirements. Each landing during this fishery is sampled for age, weight, length (AWL) information and skipper interviews are conducted to evaluate which sac roe stocks are being impacted.

For the 1998/99 season the total GHL for the two open areas was 144 tons and the harvest slightly exceeded the GHL. Due to the low number of vessels involved in this year's fishery, actual catch information is confidential. From 1970 through 1997 the food/bait harvest has ranged from 5 tons to 837 tons (Table 6). For the 1998 season a total of four vessels registered with only two that actually fished. Three tenders and three processors also registered for this fishery. Purse seine gear accounted for 100% of the harvest.

Three emergency orders (E.O.'s) were issued during the season. The first E.O. on August 14, listed fishing periods, open areas, and reminded participants of the registration requirements. The remaining E.O.'s closed the Eastside District on September 4, and the Uganik District on September 21, after the GHLs were met.

1999/2000 Management Plans and Issues

It is anticipated that the Kamishak spawning biomass may require several years to rebuild before the Kamishak sac roe fishery and the Shelikof Strait food and bait fishery are reopened. This closure will result in the continued restriction of the bait fishery to a portion of the Uganik District, south of the latitude of Miner's Point, as occurred in the 1998 season. The Eastside District will likely be open for the 1999/2000 season. The remaining districts will likely remain closed until the stock status improves. Due to the high quality of the Kodiak bait herring, the market conditions for this product are very strong. The competition between trawl and seine gear in 1999/2000 may require on the grounds monitoring of the fishery by ADF&G or additional restrictions on this fishery to control the harvest.

HERRING SUBSISTENCE FISHERY

Fishery Characteristics

The subsistence fishery for herring is regulated only during the sac roe herring fishery season, April 15 through June 30. During this time period, a subsistence permit is required for individuals to harvest herring who are not sac roe commercial fishermen. Sac roe commercial fishermen may retain herring from their lawfully taken commercial catch to fulfill their subsistence or personal use needs. Most of the herring caught during this time period are used for sport or commercial fisheries bait, food, or fertilizer. For the years 1991-1997 the number of permits issued has ranged from 16-50 and only 18-40% of the permits are returned annually with harvest data (Table 8). Annual reported harvests have ranged from 1,090 pounds to 7,600 pounds in 1991-1997. The majority of the harvests come from the vicinity of the City of Kodiak, or near the villages of Port Lions, Ouzinkie, or Akhiok, and from remote sport fishing lodges on Kodiak or Afognak Islands.

1998 Season Summary

There was only one permit issued in 1998 and the permit was not returned. No harvest data are available.

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Table 1. Historical harvest data for the commercial sac roe and food/bait herring fisheries and percent of the total annual herring harvest that occurs by fishery, Kodiak Management Area, 1964-1998.

Year	Sac Roe Fishery Harvest (Tons)	Food and Bait Fishery Harvest (Tons)	Total Herring Harvest (Tons)	Sac Roe Fishery Percent of Total Harvest (%)	Food Bait Fishery Percent of Total Harvest (%)
1964	568	310	878	65%	35%
1965	657	35	692	95%	5%
1966	2,769	198	2,967	93%	7%
1967	1,662	300	1,962	85%	15%
1968	2,001	15	2,016	99%	1%
1969	1,130	11	1,141	99%	1%
1970	342	8	350	98%	2%
1971	284	44	328	87%	13%
1972	215	50	265	81%	19%
1973	831	178	1,009	82%	18%
1974	868	40	908	96%	4%
1975	8	5	13	62%	38%
1976	5	0	5	100%	0%
1977	338	0	338	100%	0%
1978	904	399	1,303	69%	31%
1979	1,735	125	1,860	93%	7%
1980	2,383	381	2,764	86%	14%
1981	2,065	18	2,083	99%	1%
1982	1,771	326	2,097	84%	16%
1983	2,318	33	2,351	99%	1%
1984	2,163	123	2,286	95%	5%
1985	1,968	102	2,070	95%	5%
1986	1,558	213	1,771	88%	12%
1987	2,146	217	2,363	91%	9%
1988	2,171	340	2,511	86%	14%
1989	2,249	345	2,594	87%	13%
1990	2,347	313	2,660	88%	12%
1991	2,432	215	2,647	92%	8%
1992	4,283	312	4,595	93%	7%
1993	4,929	837	5,766	85%	15%
1994	5,893	677	6,570	90%	10%
1995	4,604	507	5,111	90%	10%
1996	3,386	651	4,037	84%	16%
1997	3,235	756	3,991	81%	19%
1998	2,057	a	N/A	N/A	N/A
Average 1964-1998	1,951	235	2,186	89%	11%
5 Yr. Avg. 1994-98	3,835	549	4,384	87%	13%
10 Yr. Avg. 1989-98	3,542	477	4,019	88%	12%

[a] Confidential information due to low number of permit holders involved in the fishery.

Table 2. Sac roe herring fishery summary of season length, guideline harvest level (GHL), harvest data by gear type, percentage of harvest by gear type, number of landings, and exvessel earnings, Kodiak Management Area, 1979-1998.

Year	Season Length (Days)	G-H-L (Tons)	Total Harvest (Tons)	Harvest by Gear Type		Percent Harvest by Gear Type		Number of Landings by Gear Type		Units of Gear Making Landings		Average Catch by Gear		Average Earnings		Price per Ton ($)	Exvessel Total Value ($)
				Seine (Tons)	Gillnet (Tons)	Seine	Gillnet	Seine	Gillnet	Seine	Gillnet	Seine (Tons)	Gillnet (Tons)	Seine ($)	Gillnet ($)		
1979	36	2,400	1,725	1,447	278	84%	16%	-	-	57	125	25	2	$38,342	$3,336	$1,500	$2,602,500
1980	35	2,400	2,383	2,009	374	84%	16%	-	-	92	109	22	3	$15,068	$2,368	$690	$1,644,270
1981	48	2,400	2,065	1,596	469	77%	23%	207	406	79	114	20	4	$14,647	$2,983	$725	$1,497,125
1982	59	2,400	1,771	1,447	324	82%	18%	138	191	45	67	32	5	$17,686	$2,660	$550	$974,050
1983	51	2,400	2,319	1,797	522	77%	23%	164	284	41	64	44	8	$35,063	$6,525	$800	$1,855,200
1984	54	2,400	2,163	1,691	472	78%	22%	138	212	39	69	43	7	$34,687	$5,472	$800	$1,730,400
1985	59	2,000	1,968	1,244	724	63%	37%	118	348	34	81	37	9	$32,929	$8,044	$900	$1,771,200
1986	61	1,690	1,558	1,110	448	71%	29%	132	385	31	71	36	6	$34,016	$5,994	$950	$1,480,100
1987	61	1,640	2,146	1,591	554	74%	26%	122	411	29	62	55	9	$54,862	$8,935	$1,000	$2,146,000
1988	59	2,065	2,171	1,304	867	60%	40%	169	555	33	76	40	11	$51,370	$14,830	$1,300	$2,822,300
1989	76	2,415	2,249	1,513	736	67%	33%	171	627	37	83	41	9	$34,749	$7,535	$850	$1,911,149
1990	75	2,375	2,347	1,644	703	70%	30%	156	544	27	63	61	11	$51,756	$9,485	$850	$1,994,950
1991	93	2,510	2,432	1,697	735	70%	30%	169	587	32	64	53	11	$45,077	$9,762	$850	$2,067,200
1992	77	2,720	4,283	3,260	1,023	76%	24%	185	706	40	74	82	14	$40,750	$6,912	$500	$2,141,500
1993	77	3,525	4,929	4,203	726	85%	15%	237	294	41	86	103	8	$56,382	$4,643	$550	$2,710,950
1994	71	4,550	5,893	4,976	917	84%	16%	285	485	66	57	75	16	$60,315	$12,870	$800	$4,714,400
1995	73	4,480	4,804	3,837	766	83%	17%	280	642	73	71	53	11	$68,856	$13,758	$1,272	$5,856,288
1996	69	4,180	3,386	2,322	1,064	69%	31%	202	690	67	74	41	14	$81,474	$28,757	$2,000	$6,772,000
1997	49	3,435	3,235	2,629	606	81%	19%	183	418	64	59	41	10	$12,323	$3,081	$300	$970,500
1998	**50**	**2,030**	**2,057**	**1,954**	**103**	**95%**	**5%**	**110**	**28**	**38**	**7**	**50**	**15**	**$16,749**	**$4,414**	**$300**	**$617,100**
Averages																	
1979-1998	61.15	2,701	2,785	2,164	621	77%	23%	158	401	48	74	48	9	$39,755	$8,118	$874	$2,413,959
Five Year																	
1993-1997	67.8	4,034	4,409	3,593	816	81%	19%	237	546	60	69	62	12	$55,470	$12,622	$984	$4,204,828
Ten Year																	
1988-1997	70.9	3,226	3,553	2,739	815	75%	25%	204	575	47	71	59	12	$50,105	$11,163	$927	$3,196,124

Table 3. Comparison of the guideline harvest level (GHL) to the sac roe herring fishery harvest for the major fishery districts pre and post 1995 Board of Fisheries regulation changes, Kodiak Management Area, 1993-1998.

		Year			Average	Year			Average
West Afognak District		**1993**	**1994**	**1995**	**1993-1995**	**1996**	**1997**	**1998**	**1996-1998**
	GHL (tons)	465	855	1,135	818	1,180	820	510	837
	Harvest (tons)	1,586	1,049	1,568	1,401	944	869	553	789
Percent of harvest above or (-) below the GHL		241%	23%	38%	71%	-20%	6%	8%	-6%
Uganik District									
	GHL (tons)	620	805	915	780	935	940	650	842
	Harvest (tons)	1,075	2,284	1,340	1,566	963	1,272	777	1,004
Percent of harvest above or (-) below the GHL		73%	184%	46%	101%	3%	35%	20%	19%
Eastside District									
	GHL (tons)	790	1,220	1,265	1,092	1,190	900	640	910
	Harvest (tons)	1,125	1,324	1,147	1,199	825	701	654	727
Percent of harvest above or (-) below the GHL		42%	9%	-9%	10%	-31%	-22%	2%	-20%
Alitak District									
	GHL (tons)	590	805	660	685	530	485	75	363
	Harvest (tons)	774	891	424	696	449	320	74	281
Percent of harvest above or (-) below the GHL		31%	11%	-36%	2%	-15%	-34%	-1%	-23%

Table 4. Sac roe herring fishery guideline harvest level (GHL) by management section, harvest by gear type, total harvest, and the date each section was closed, Kodiak Management Area, 1998.

Statistical Area	Management Section	GHL (Tons)	Seine Harvest (Tons)	Gillnet Harvest (Tons)	Total Harvest (Tons)	Date Management Section Closed
North Afognak District						
NA10	Shuyak Island	Closed	0.0	0.0	0.0	-
NA20	Delphin Bay	Closed	0.0	0.0	0.0	-
NA30	Perenosa Bay	Closed	0.0	0.0	0.0	-
NA40	Seal Bay	Closed	0.0	0.0	0.0	-
NA50	Tonki Bay	15	0.0	0.0	0.0	30-Jun
District Total		**15**	**0.0**	**0.0**	**0.0**	
West Afognak District						
WA10	Raspberry Strait	Closed	0.0	0.0	0.0	-
WA20	Malina Bay	Closed	0.0	0.0	0.0	-
WA31	Paramanof Bay	400	438.3	14.7	453.0	15-Apr
WA32	Foul Bay	100	99.7	0.0	99.7	21-Apr
WA40	Devils Inlet/Bluefox B.	10	0.0	0.0	0.0	30-Jun
WA50	Offshore W. Afognak	Closed	0.0	0.0	0.0	-
District Total		**510**	**538.0**	**14.7**	**552.7**	
South Afognak District						
SA10	Izhut Bay	Closed	0.0	0.0	0.0	-
SA20	Kitoi Bay	Closed	0.0	0.0	0.0	-
SA30	MacDonalds Lagoon	Closed	0.0	0.0	0.0	-
SA40	Danger Bay	Closed	0.0	0.0	0.0	-
SA50	Litnik	Closed	0.0	0.0	0.0	-
SA60	Duck Bay	Closed	0.0	0.0	0.0	-
District Total		**Closed**	**0.0**	**0.0**	**0.0**	
Uganik District						
UG10	Kupreanof	Closed	0.0	0.0	0.0	-
UG20	Viekoda Bay	75	189.2	0.0	189.2	19-Apr
UG21	Terror Bay	200	155.3	27.3	182.6	2-May
UG30	Village Island	150	134.1	3.6	137.7	17-Apr
UG31	W. Uganik Pass	20	38.4	0.0	38.4	3-May
UG32	NE. Arm Uganik	30	0.0	0.0	0.0	30-Jun
UG33	E. Arm Uganik	75	99.9	0.5	100.4	23-Apr
UG34	S. Arm Uganik	100	124.9	3.9	128.8	24-Apr
UG40	Offshore Uganik	Closed	0.0	0.0	0.0	-
District Total		**650**	**741.8**	**35.3**	**777.1**	

-Continued-

Table 4. (page 2 of 3)

Statistical Area	Management Section	GHL (Tons)	Seine Harvest (Tons)	Gillnet Harvest (Tons)	Total Harvest (Tons)	Date Management Section Closed
Uyak District						
UY10	Offshore Uyak	Closed	0.0	0.0	0.0	-
UY20	Harvester Island	Closed	0.0	0.0	0.0	-
UY30	Inner Uyak Bay	Closed	0.0	0.0	0.0	-
UY31	Larsen Bay	Closed	0.0	0.0	0.0	-
UY32	Browns Lagoon	Closed	0.0	0.0	0.0	-
UY40	Zachar Bay	Closed	0.0	0.0	0.0	-
UY50	Spiridon Bay	Closed	0.0	0.0	0.0	-
District Total		**Closed**	**0.0**	**0.0**	**0.0**	
Alitak District						
AL10	Outer Alitak	Closed	0.0	0.0	0.0	-
AL20	Inner Alitak	10	0.0	1.5	1.5	30-Jun
AL21	Inner Deadman Bay	Closed	0.0	0.0	0.0	-
AL22	Outer Deadman Bay	Closed	0.0	0.0	0.0	-
AL30	Sulua Bay	Closed	0.0	0.0	0.0	-
AL31	Portage Bay	50	58.5	0.0	58.5	4-Jun
AL40	Lower Olga/Moser	Closed	0.0	0.0	0.0	-
AL41	N.Upper Olga Bay	Closed	0.0	0.0	0.0	-
AL50	Upper Olga Bay	Closed	0.0	0.0	0.0	-
AL60	Geese/Twoheaded	15	13.8	0.0	13.8	14-May
District Total		**75**	**72.3**	**1.5**	**73.8**	
Sturgeon/Halibut District						
SH10	Sturgeon/Halibut	Closed	0.0	0.0	0.0	-
Eastside District						
EA10	Kaiugnak	10	0.0	0.0	0.0	30-Jun
EA20	SW. Sitkalidak	10	0.0	0.0	0.0	30-Jun
EA21	Three Saints Bay	30	0.0	9.4	9.4	30-Jun
EA22	Newman Bay	10	0.0	0.0	0.0	30-Jun
EA23	W.Sitkalidak Bay	50	57.5	4.1	61.6	7-May
EA24	Barling Bay	40	48.8	0.0	48.8	23-Apr
EA30	E.Sitkalidak Strait	50	16.7	15.6	32.3	30-Jun
EA31	Tanginak Anchorage	Closed	0.0	0.0	0.0	-
EA40	Outer Sitkalidak	Closed	0.0	0.0	0.0	-
EA41	Boulder Bay	10	0.0	0.0	0.0	30-Jun
EA42	Shearwater Bay	90	96.3	3.0	99.3	28-Apr
EA43	Outer Kiliuda Bay	90	79.4	10.1	89.5	28-Apr
EA44	Inner Kiliuda Bay	90	88.7	0.0	88.7	25-Apr
EA50	Outer Ugak Bay	60	82.3	0.0	82.3	24-Apr
EA51	Inner Ugak Bay	90	107.3	9.1	116.4	30-Apr
EA52	Pasagshak Bay	10	25.4	0.0	25.4	14-May
District Total		**640**	**602.4**	**51.3**	**653.7**	

-Continued-

Table 4. (page 3 of 3)

Statistical Area	Management Section	GHL (Tons)	Seine Harvest (Tons)	Gillnet Harvest (Tons)	Total Harvest (Tons)	Date Management Section Closed
Northeast District						
NE10	Womens Bay	Closed	0.0	0.0	0.0	-
NE20	Kalsin Bay	Closed	0.0	0.0	0.0	-
NE30	Middle Bay	Closed	0.0	0.0	0.0	-
NE40	Inshore Chiniak	Closed	0.0	0.0	0.0	-
NE50	Offshore Chiniak	Closed	0.0	0.0	0.0	-
District Total		**Closed**	**0.0**	**0.0**	**0.0**	
Inner Marmot District						
IM10	Monashka Bay	Closed	0.0	0.0	0.0	-
IM20	Anton Larsen Bay	Closed	0.0	0.0	0.0	-
IM30	Sharatin Bay	Closed	0.0	0.0	0.0	-
IM40	Kizhuyak Bay	Closed	0.0	0.0	0.0	-
IM50	Spruce Island	Closed	0.0	0.0	0.0	-
District Total		**Closed**	**0.0**	**0.0**	**0.0**	-
North Mainland District						
NM10	Hallo Bay	Closed	0.0	0.0	0.0	-
NM20	Inner Kukak	25	0.0	0.0	0.0	30-Jun
NM30	Outer Kukak	Closed	0.0	0.0	0.0	-
NM40	Missak Bay	Closed	0.0	0.0	0.0	-
District Total		**25**	**0.0**	**0.0**	**0.0**	
Mid Mainland District						
MM10	Inner Katmai	50	0.0	0.0	0.0	30-Jun
MM20	Outer Katmai	Closed	0.0	0.0	0.0	-
MM30	Alinchak	15	0.0	0.0	0.0	30-Jun
MM40	Puale Bay	Closed	0.0	0.0	0.0	-
MM50	Portage Bay	Closed	0.0	0.0	0.0	-
MM60	Outer Portage-Puale	Closed	0.0	0.0	0.0	-
District Total		**65**	**0.0**	**0.0**	**0.0**	
South Mainland District						
SM10	Wide Bay	50	0.0	0.0	0.0	30-Jun
SM20	Lower Shelikof	Closed	0.0	0.0	0.0	-
District Total		**50**	**0.0**	**0.0**	**0.0**	
Grand Total		**2,030**	**1,954.5**	**102.8**	**2,057.3**	

Table 5. Age composition by percent of the sac roe herring samples from the commercial purse seine harvest by section, Kodiak Management Area, 1998.[a]

District Section	Harvest (tons)	Percent at Age										
		Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10	Age-11+	n
W. Afognak District												
Paramanof Bay	453.0	0.0	2.3	19.2	26.4	7.1	4.9	6.0	6.2	24.9	2.5	545
Foul Bay	99.7	0.0	1.4	23.7	34.7	6.4	6.6	2.9	3.4	19.6	0.9	636
Uganik District												
Viekoda Bay	189.2	0.0	4.1	60.0	24.8	2.5	0.9	1.2	0.0	6.1	0.0	310
Terror Bay	182.6	0.0	6.2	50.6	25.4	5.2	2.1	0.3	1.2	7.4	1.2	322
W. Uganik Passage	38.4	0.2	2.0	77.3	12.4	1.8	0.6	1.6	0.4	2.2	1.0	482
Village Islands	137.7	0.0	3.6	53.4	14.1	3.3	3.8	4.4	2.2	14.3	0.4	627
E. Arm Uganik	100.4	0.0	3.5	58.8	17.9	5.1	1.5	2.8	1.7	7.4	1.0	391
S. Arm Uganik	128.8	0.0	16.0	57.4	10.0	1.6	1.4	1.4	1.8	9.6	0.8	500
Eastside District												
W. Sitkalidak Straits	61.6	0.0	0.0	5.7	82.6	0.5	4.6	0.0	0.0	2.8	3.4	173
Barling Bay	48.8	0.0	0.7	11.5	66.5	2.7	8.3	0.3	0.3	5.1	3.9	251
E. Sitkalidak Straits	32.3	1.0	1.0	2.6	86.9	0.5	4.1	0.0	0.0	1.5	2.0	192
Shearwater Bay	99.3	0.2	0.0	2.0	69.2	0.1	7.9	0.0	0.8	1.4	17.9	669
Outer Kiliuda Bay	89.5	0.8	0.6	3.0	73.4	0.4	4.7	0.0	1.5	3.2	11.9	460
Inner Kiliuda Bay	88.7	1.7	0.8	5.2	72.5	0.6	3.3	0.1	0.9	3.0	11.3	624
Pasagshak Bay	25.4	0.2	0.9	4.7	85.4	0.9	2.5	0.7	0.7	0.4	3.2	425
Outer Ugak Bay	82.3	0.0	1.2	21.3	75.9	0.2	0.5	0.0	0.2	0.0	0.5	399
Inner Ugak Bay	116.4	0.0	0.0	3.1	94.4	0.0	0.2	0.0	0.5	0.5	1.0	379
All samples combined 17 sections [b]	1,974	0.2	3.2	30.1	40.9	3.5	3.4	2.3	2.3	10.6	3.2	7,385

[a] Of the 21 management units exploited in 1998, samples were collected from 17 (81%). These 17 units yielded 1,974 tons or 96% of the management area's total harvest of 2,057 tons.

[b] All samples combined data, weights the percent of the harvest by section to the age class data to estimate the combined purse seine age composition.

Table 6. Historical food and bait herring harvest for the Kodiak Management Area, 1912-1998.

Year	Tons	Year	Tons	Year	Tons
1912	20	1941	40,084	1970	8
1913	0	1942	16,791	1971	44
1914	0	1943	35,352	1972	50
1915	0	1944	26,835	1973	178
1916	70	1945	31,114	1974	40
1917	138	1946	47,506	1975	5
1918	118	1947	50,743	1976	No data
1919	260	1948	46,428	1977	No data
1920	46	1949	0	1978	399
1921	945	1950	44,133	1979	125
1922	1,483	1951	4,299	1980	381
1923	322	1952	1,389	1981	18
1924	4,823	1953	725	1982	326
1925	9,997	1954	0	1983	33
1926	2,681	1955	0	1984	123
1927	2,593	1956	13,524	1985	102
1928	625	1957	21,219	1986	213
1929	No data	1958	1,711	1987	217
1930	622	1959	3,831	1988	340
1931	1,000	1960	0	1989	345
1932	3,594	1961	0	1990	313
1933	2,313	1962	0	1991	215
1934	60,000	1963	0	1992	312
1935	No data	1964	310	1993	837
1936	24,748	1965	35	1994	677
1937	27,659	1966	198	1995	507
1938	24,522	1967	300	1996	651
1939	38,601	1968	15	1997	756
1940	22,677	1969	11	1998	[a]

[a] Confidential information due to low numbers of permit holders participating.

Table 7. Harvest by gear type, total harvest, and percent harvest by gear type for the food and bait herring fishery, Kodiak Management Area, 1978-1998.

Year	Harvest by Gear Type (tons)				Percent Harvest by Gear Type		
	Seine	Gillnet	Trawl	Total	Seine	Gillnet	Trawl
1978	3.2	2.9	392.8	398.9	0.8%	0.7%	98.5%
1979	0	0	124.8	124.8	0.0%	0.0%	100.0%
1980	0	5.8	374.9	380.7	0.0%	1.5%	98.5%
1981	0	0.4	17.6	18	0.0%	2.2%	97.8%
1982	311	13.5	1.5	326	95.4%	4.1%	0.5%
1983	0	3.2	30.2	33.4	0.0%	9.6%	90.4%
1984	3.5	0	119.5	123	2.8%	0.0%	97.2%
1985	0	0.4	101.6	102	0.0%	0.4%	99.6%
1986	17.3	0	195.7	213	8.1%	0.0%	91.9%
1987	15.6	0.6	200.8	217	7.2%	0.3%	92.5%
1988	0	0	340.2	340.2	0.0%	0.0%	100.0%
1989	0	0	344.6	344.6	0.0%	0.0%	100.0%
1990	0	0	312.6	312.6	0.0%	0.0%	100.0%
1991	20.9	0	194.4	215.3	9.7%	0.0%	90.3%
1992	0	0.6	310.4	311	0.0%	0.2%	99.8%
1993	377.8	0	458.9	836.7	45.2%	0.0%	54.8%
1994	256.1	0	421	677.1	37.8%	0.0%	62.2%
1995	169.8	0	337	506.8	33.5%	0.0%	66.5%
1996	432.9	0	218.9	651.8	66.4%	0.0%	33.6%
1997	550	0	203.8	753.8	73.0%	0.0%	27.0%
1998	a	0	0	a	100.0%	0.0%	0.0%
AVG.1993-98	323.0	0.0	273.3	596.3	54.2%	0.0%	45.8%
AVG.1987-92	6.1	0.2	283.8	290.1	2.1%	0.1%	97.8%

[a] Confidential information due to the low number of permit holders participating in the fishery.

Table 8. Subsistence herring harvest summary for the Kodiak Management Area, 1991-1998.

Year	Number Permits Issued	Number Permits Returned	Estimated Harvest (lbs.) by District						
			Afognak	Northeast	Inner Marmot	Uganik	Uyak	Alitak	Total
1991	50	9	2,110	1,745	1,745	1,000	0	0	6,600
1992	45	10	120	250	250	1,000	0	320	1,940
1993	50	16	90	3,000	3,910	550	50	0	7,600
1994	47	14	90	740	1,350	2,000	200	0	4,380
1995	20	6	75	0	500	0	340	175	1,090
1996	23	10	550	180	140	0	590	0	1,460
1997	16	7	0	200	350	50	1,325	0	1,925
1998	1	0	0	0	0	0	0	0	0

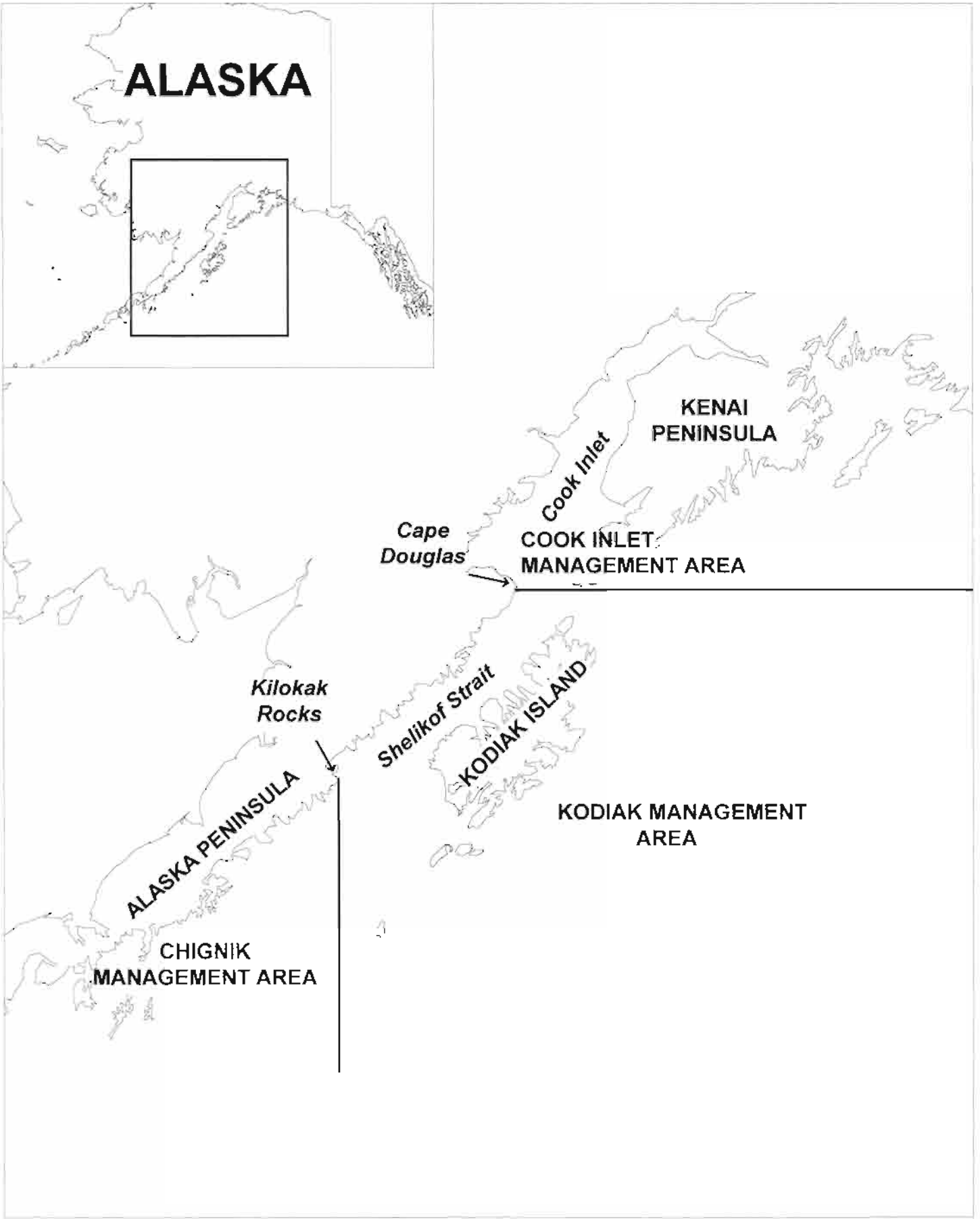

Figure 1. Map of southwestern Alaska emphasizing the Kodiak Management Area and it's relationship to surrounding mangement areas.

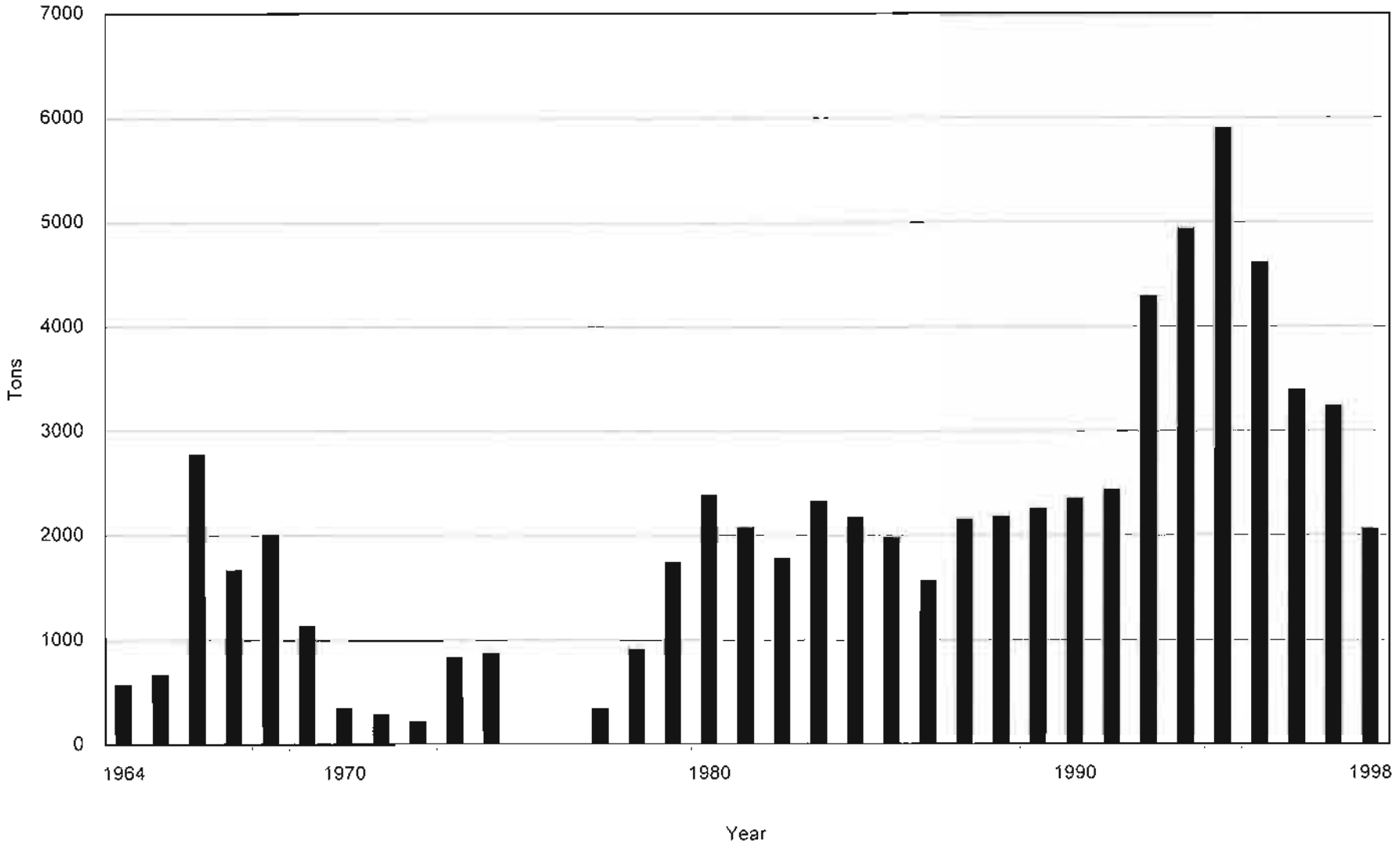

Figure 2. Historical sac roe herring harvest for the Kodiak Management Area, 1964-1998.

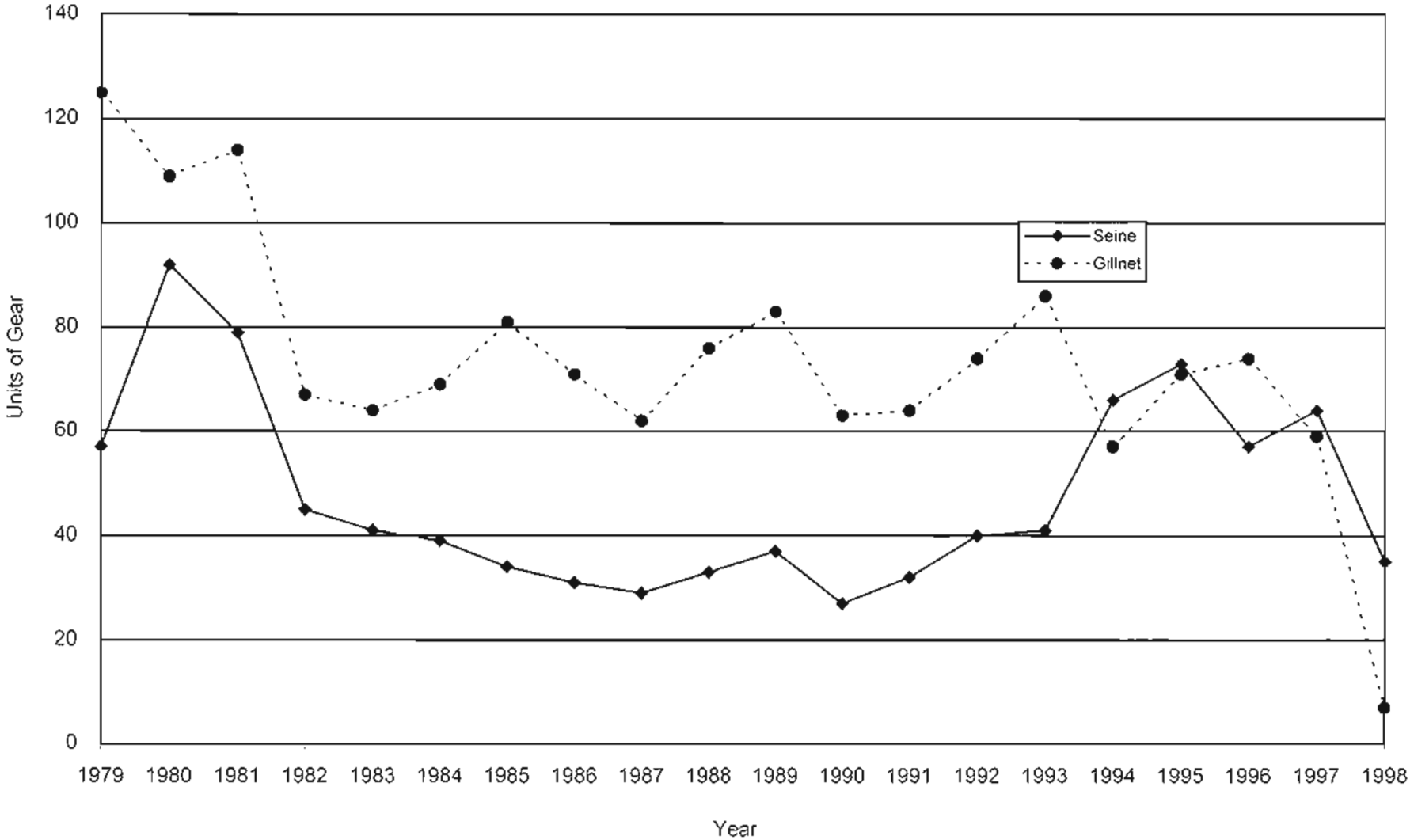

Figure 3. Number of units of each gear type that made landings in the sac roe herring fishery, Kodiak Management Area 1979-1998.

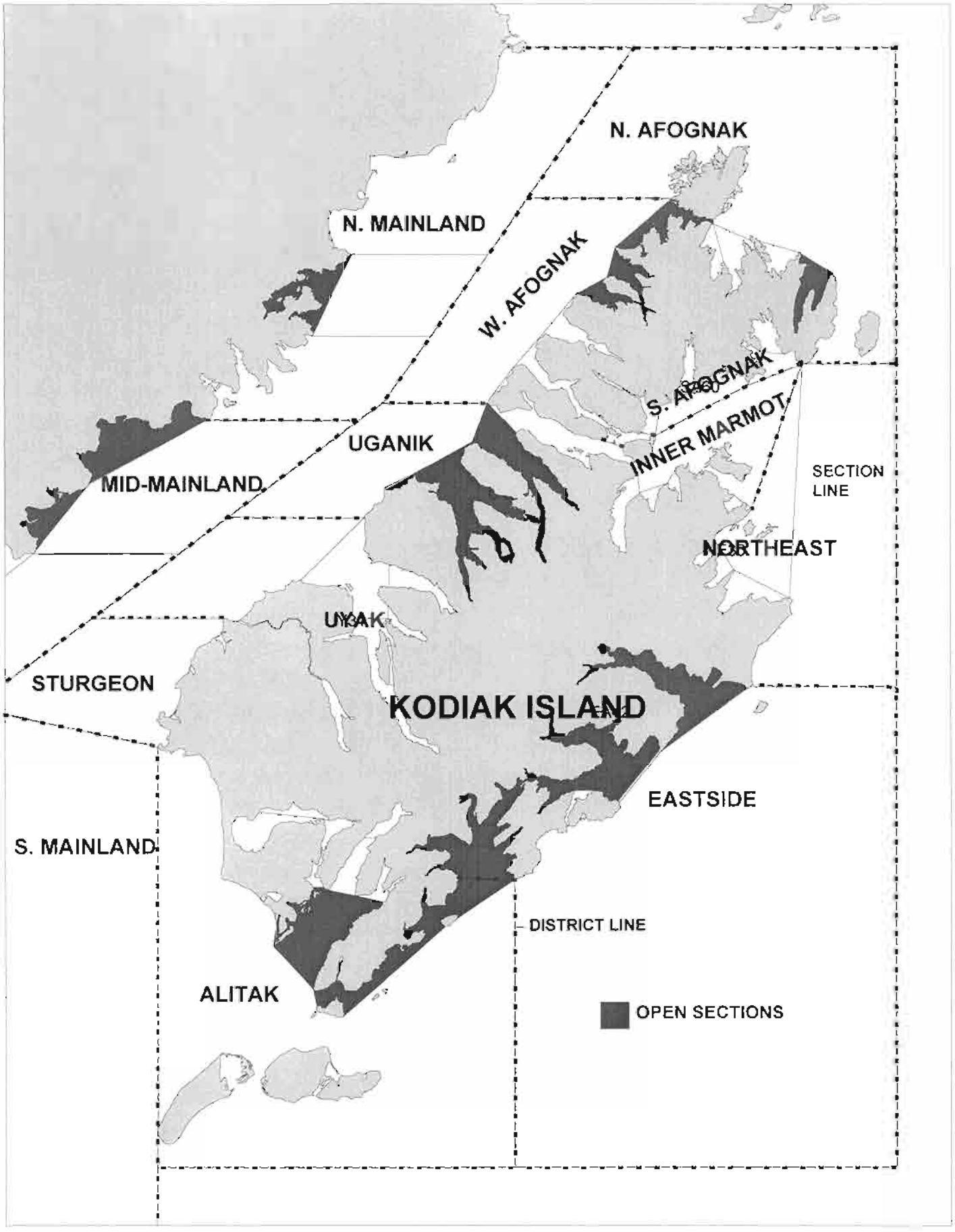

Figure 4. Map of districts and open sections to commercial sac roe herring fishing, Kodiak Management Area, 1998.

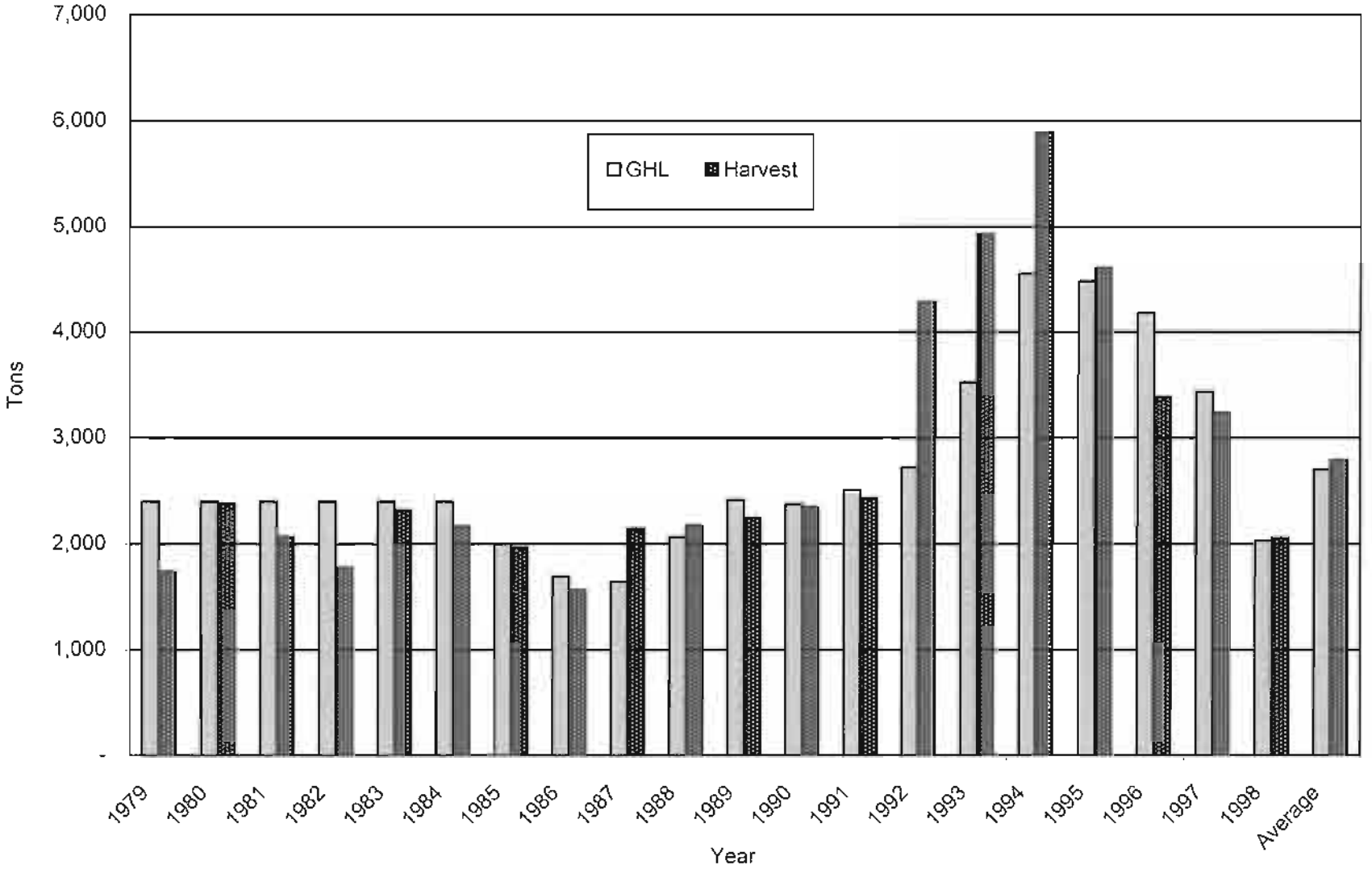

Figure 5. Comparison of the guideline harvest level (GHL) to the sac roe herring harvest in the Kodiak Management Area, 1979-1998.

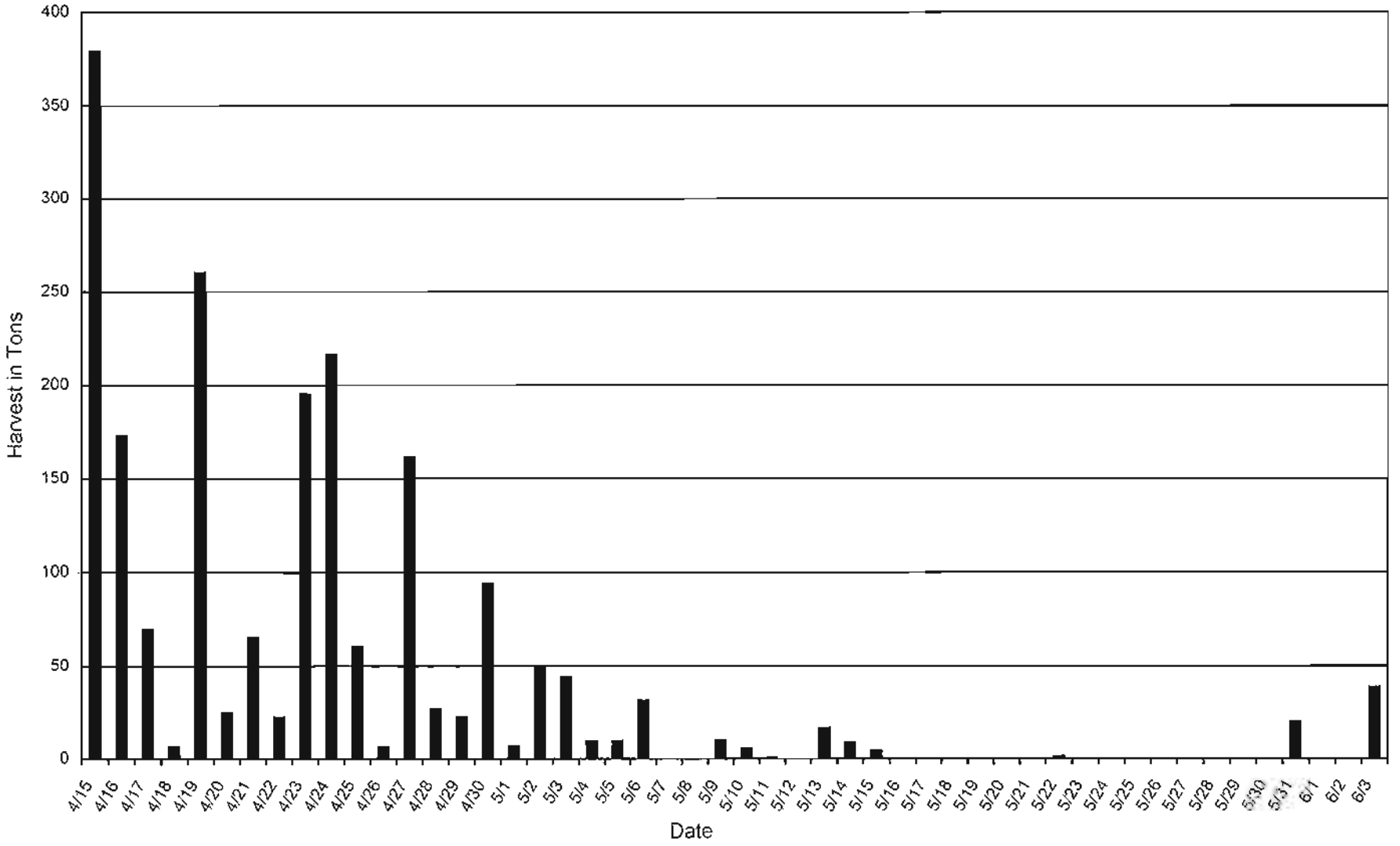

Figure 6. Harvest by day for the sac roe herring fishery, Kodiak Management Area, 1998.

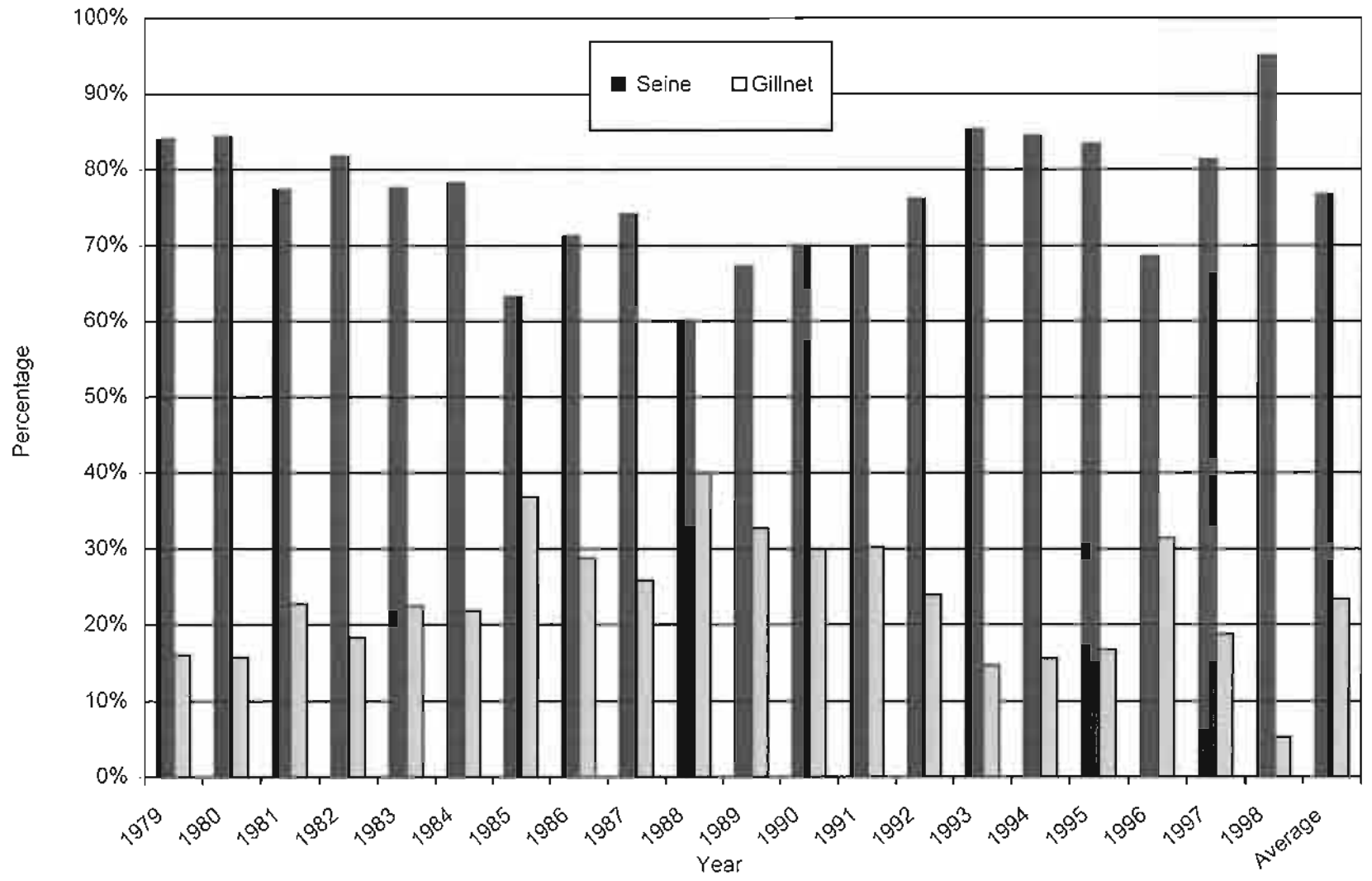

Figure 7. Percent of total sac roe herring fishery harvest taken by gear type Kodiak Management Area, 1979-1998.

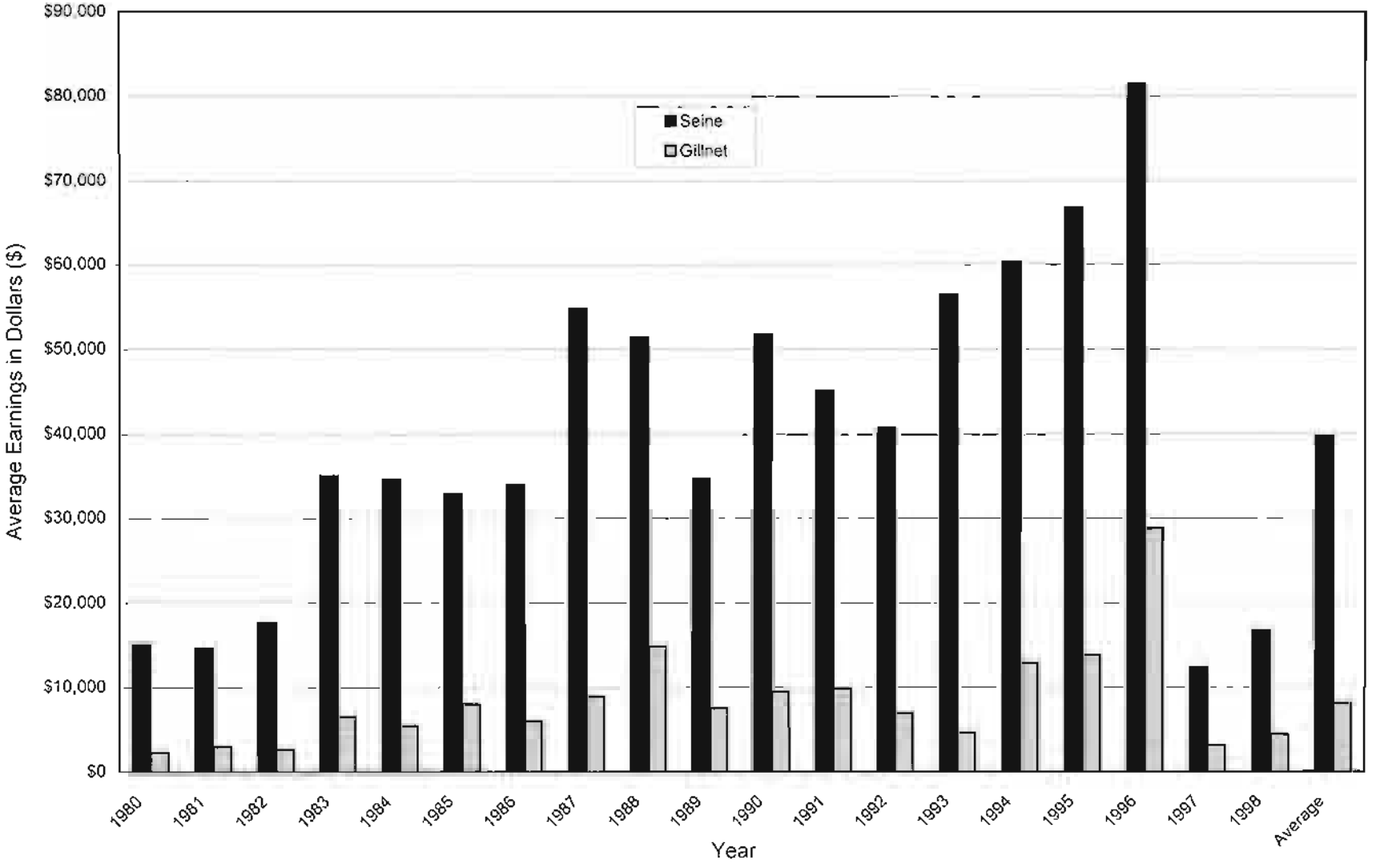

Figure 8. Average earnings by gear type for the sac roe herring fishery, Kodiak Management Area 1979-1998.

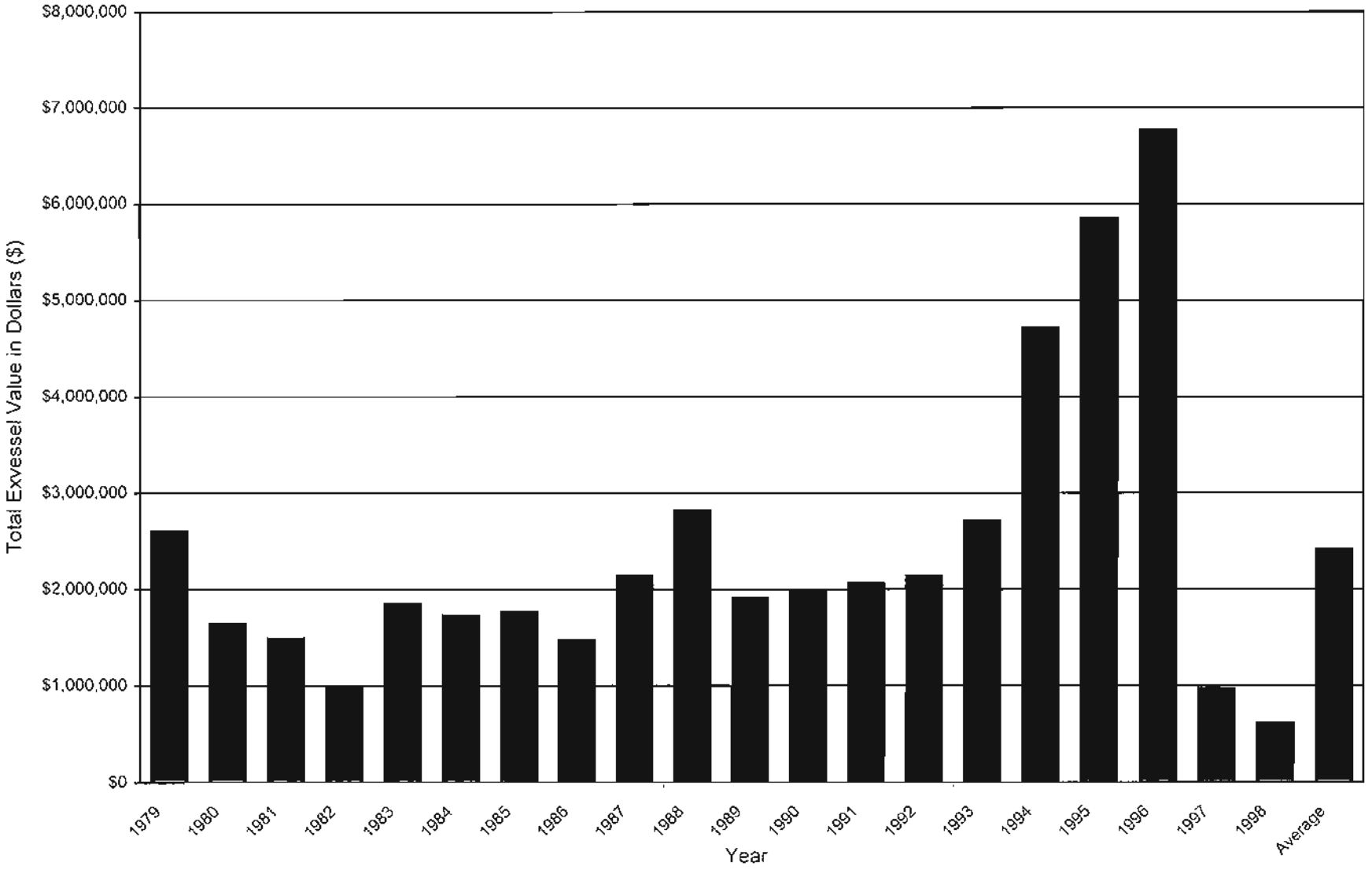

Figure 9. Total exvessel value of the sac roe herring fishery, Kodiak Management Area, 1979-1998.

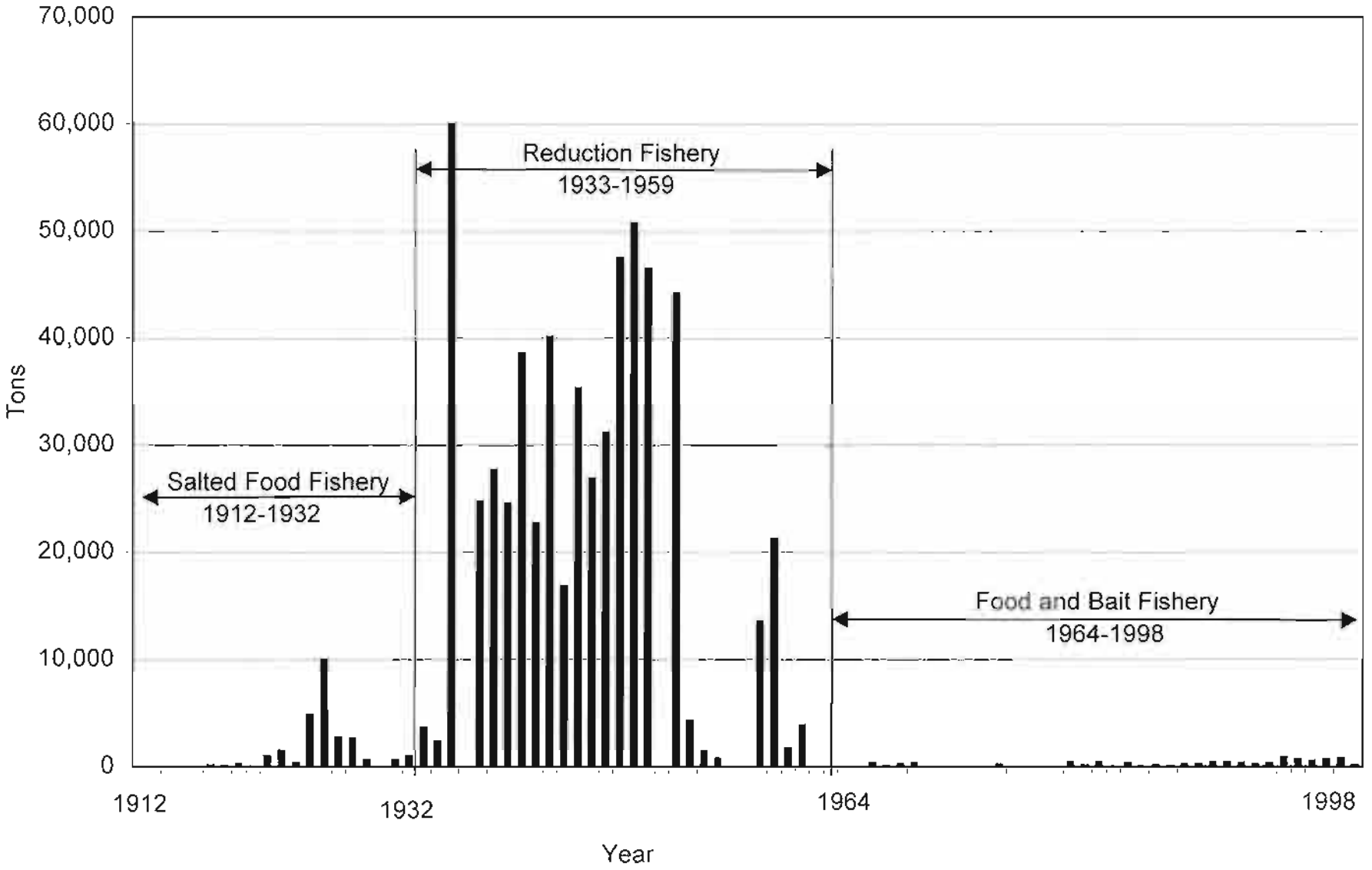

Figure 10. Historical food and bait herring fishery harvest for the Kodiak Management area, 1912-1998.

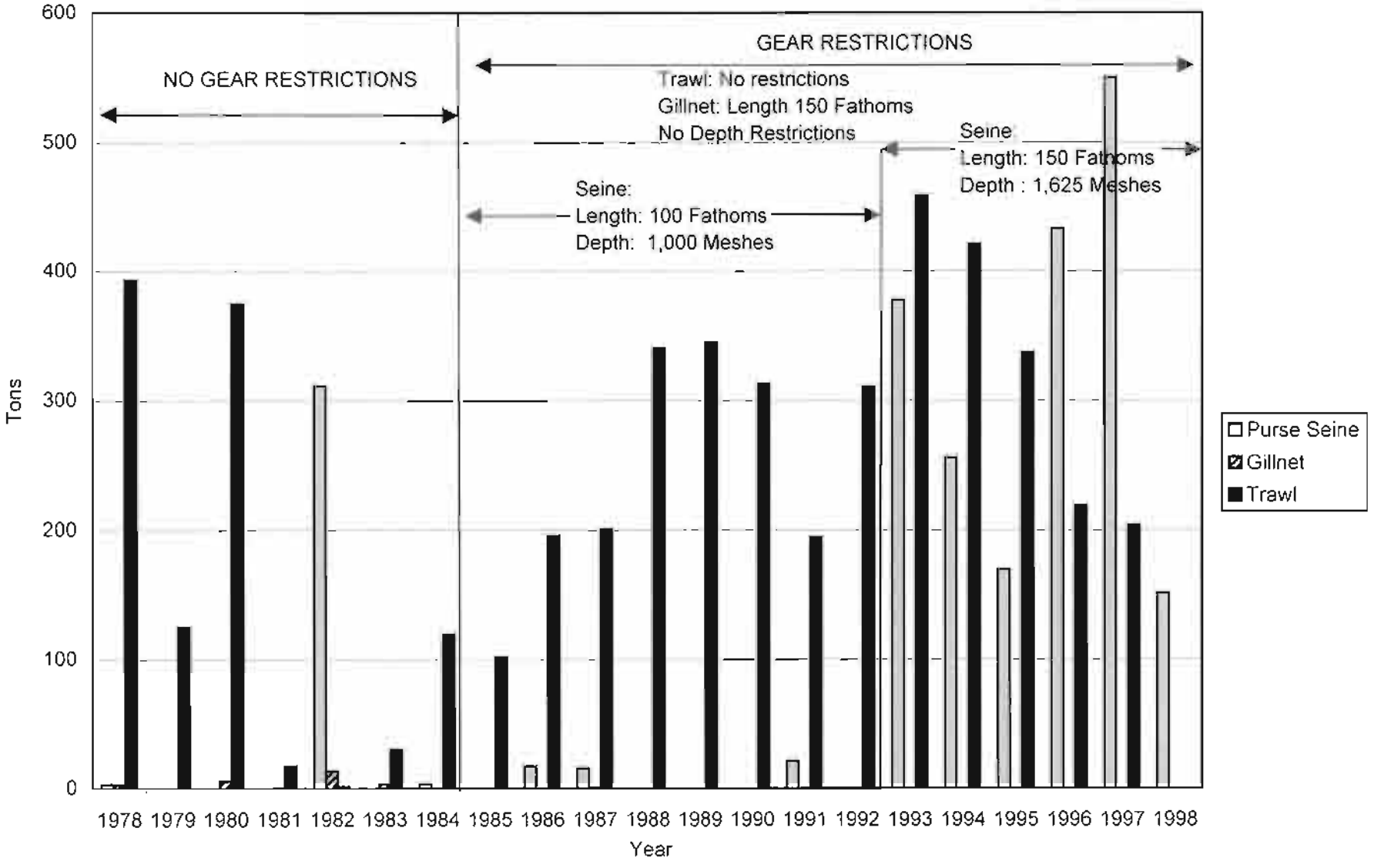

Figure 11. Harvest by gear type and gear restrictions for the food and bait herring fishery, Kodiak Management Area 1978-1998.

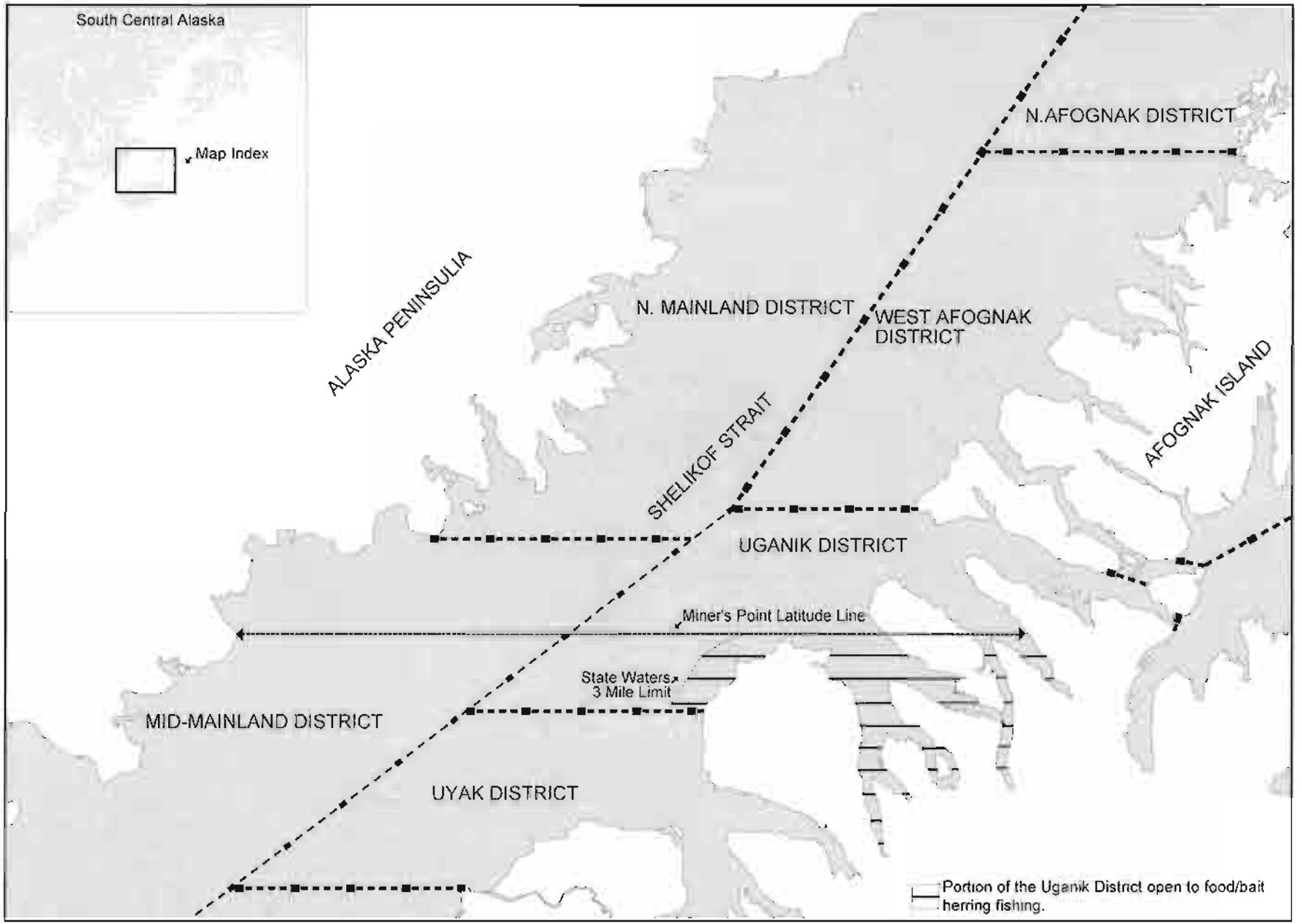

Figure 12. Map of the Uganik District showing that portion south of the latitude of Miner's Point that is open to food and bait herring fishing for the 1998/99 season.